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FLOOD INSURANCE STUDY

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JASPER COUNTY, SOUTH CAROLINA

UNINCORPORATED AREAS

SEPTEMBER 29, 1986

Federal Emergency Management Agency

COMMUNITY NUMBER - 450112

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Flood Insurance Rate Map

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FLOOD INSURANCE STUDY

JASPER COUNTY,
UNINCORPORATED AREAS,
SOUTH CAROLINA

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study investigates the existence and severity of flood hazards in the Unincorporated Areas of Jasper County, South Carolina, and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study has developed flood risk data for various areas of the community that will be used to establish actuarial flood insurance rates and assist the community in its efforts to promote sound flood plain management. Minimum flood plain management requirements for participation in the National Flood Insurance Program are set forth in the Code of Federal Regulations at 44 CFR, 60.3.

In some states or communities, flood plain management criteria or regulations may exist that are more restrictive or comprehensive than the minimum Federal requirements. In such cases, the more restrictive criteria take precedence and the state (or other jurisdictional agency) will be able to explain them.

1.2 Authority and Acknowledgments

The sources of authority for this Flood Insurance Study are the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

The hydrologic and hydraulic analyses for the coastal flooding from the Atlantic Ocean were performed by Post, Buckley, Schuh & Jernigan, Inc. (the Study Contractor) for the Federal Emergency Management Agency (FEMA), under Contract No. EMW-C-0947. This study was completed in December 1984. All riverine flooding information was taken from the Type 19 Flood Insurance Study for the Unincorporated Areas of Chatham County, Georgia (Reference 1).

1.3 Coordination

The initial coordination meeting, held in the Town of Ridgeland, South Carolina, on November 8, 1983, was attended by representatives of the county, FEMA, and the Study Contractor. The meeting was held to explain the nature and purpose of this study, to outline the scope and limits of the work, as well as to obtain flood information currently available concerning the county.

On November 18, 1985, the results of this Flood Insurance Study were reviewed and accepted at a final coordination meeting attended by representatives of the Study Contractor, FEMA, and the community.

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2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the unincorporated areas of Jasper County, South Carolina. The area of study is shown on the Vicinity Map (Figure 1). The incorporated areas within the county were excluded from this study.

Flooding caused by overflow of the Savannah River was studied in detail from U.S. Route 17 to about 5.1 miles upstream of U.S. Route 17.

A detailed coastal flooding analysis was performed on the complete coastline of Jasper County, where the flooding source is the Atlantic Ocean.

Approximate analyses were used to study those areas having a low development potential or minimal flood hazards.

The areas studied were selected with priority given to all known flood hazard areas and areas of projected development or proposed construction through December 1989. The scope and methods of study were proposed to and agreed upon by FEMA and Jasper County.

2.2 Community Description

Jasper County, approximately 669 square miles in area, is located in the southeastern portion of South Carolina in the Atlantic coastal plain. The county is bordered by Beaufort County on the northeast across the New River, Chatham County on the southwest, Effingham County on the west across the Savannah River, Hampton County on the north, and the Atlantic Ocean on the south. The Atlantic Ocean coastline accounts for about 4 miles of the county's border. In 1980, the population of Jasper County was reported to be 14,504 (Reference 2).

Jasper County lies in the southernmost region of South Carolina where the climate is sub-tropical with long, hot summers followed by short, mild winters. The mean temperatures in Jasper County range from a low of 38 degrees Fahrenheit (F.) in January to a high of 90 degrees F. in July. Precipitation is abundant, averaging about 49 inches per year and remaining within the range of 40 to 50 inches during most years (Reference 3). The annual rainfall distribution shows a maximum of about 7 inches in July and a minimum of about 2 inches in November. The period of April through October, which includes the growing season for most crops in this area, receives an average of about 34 inches of rain.

The county is situated on a low coastal plain with part of the area consisting of tidal marshes and swamps. Most of the area consists of nearly level lowlands and low ridges that have slopes generally less than 2 percent. Elevations range from sea level at the coast to approximately 100 feet mean sea level (msl) in the northern portions of the county.

Although several rivers and streams are within or adjacent to the county's area, about 90 percent of the soils have high water tables. The Savannah River, the western boundary of Jasper County, is the only stream that does

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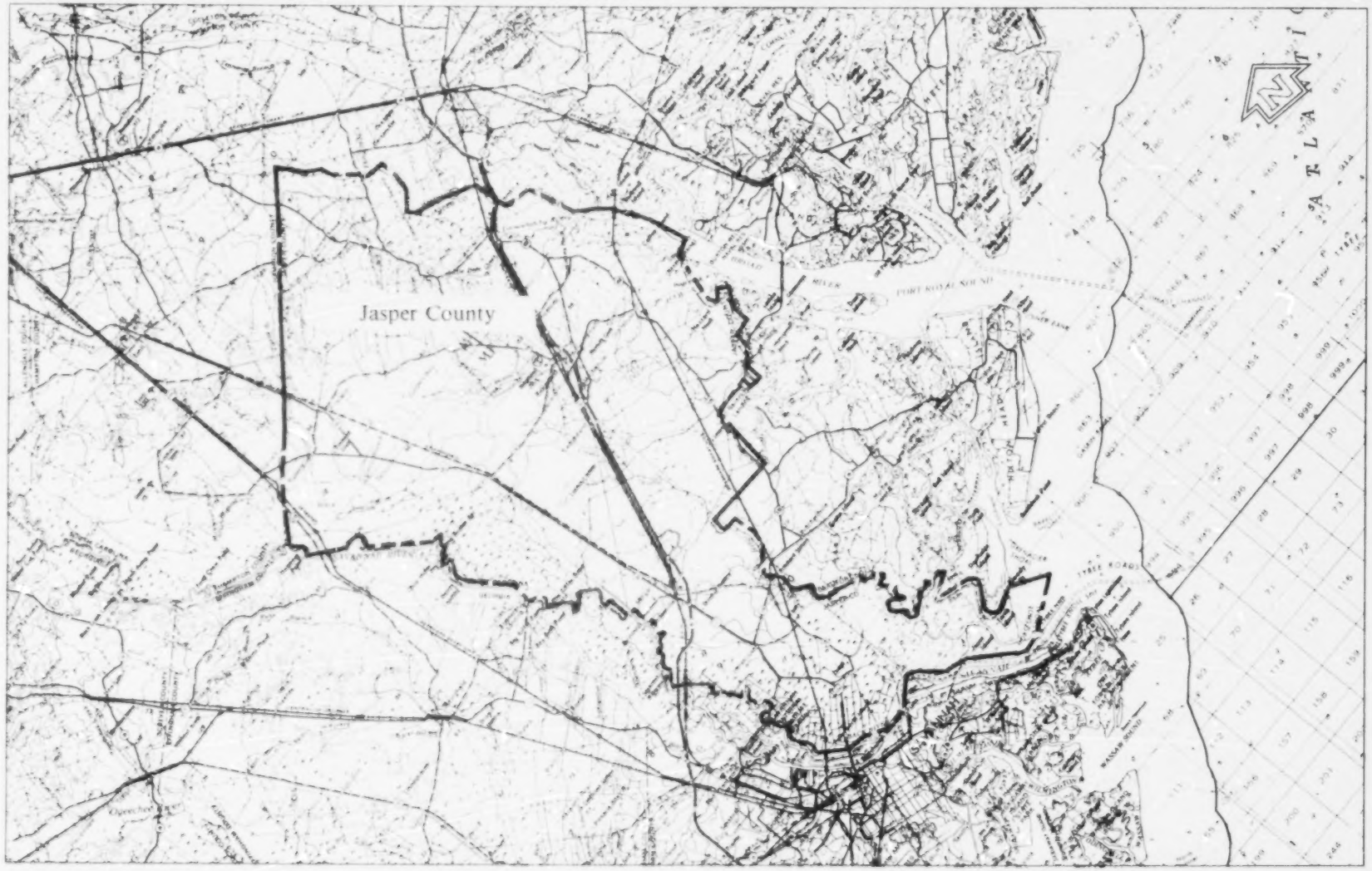

FIGURE 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

JASPER COUNTY, SC

(UNINCORPORATED AREAS)

APPROXIMATE SCALE

8 0 8 16 24 MILES

VICINITY MAP

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not originate in the coastal plain. Its watershed in Jasper County is very narrow, extending only 2 to 5 miles east of the river (Reference 3). The New River, forming the eastern boundary of the county, has a fairly large watershed, extending beyond the county boundaries, but because of its low gradient, this watershed is largely influenced by tidal conditions. The Wright River, which drains the lower central part of Jasper County, has its drainage area within the county limits and is considered as a tidal estuary.

Much of the land situated in the flood plain is undeveloped marshland and agricultural land with some residential and commercial development. Principal residential, commercial, and industrial development in the county is located relatively far away from the coastline. The major types of employment in Jasper County are agriculture, government services, manufacturing/construction, and retail/wholesale trade. This employment base is closely tied to the tourism served by Interstate 95 (Reference 4).

2.3 Principal Flood Problems

Jasper County is subject to flooding caused by hurricanes and tropical storms. The primary factors contributing to flooding in Jasper County are its openness to Atlantic Ocean surges and unfavorable bathymetry extending offshore. The principle streams within the county have wide mouths and are bordered by extensive areas of low marsh. In addition, the terrain at the coast is generally too low to provide an effective barrier. The offshore ocean depths are shallow for great distances generating a high Atlantic Ocean surge.

Historical hurricane data for Jasper County have not been recorded in the past probably because no significant development has been established along the county's floodprone area. However, detailed data have been compiled for Savannah, Georgia, which is located just southwest of the Jasper County, South Carolina-Chatham County, Georgia, boundary limits.

A storm history for Savannah, Georgia, and its vicinity during the past 100-years is summarized below (References 5 and 6) as it is quite probable that hurricanes that have affected the Savannah, Georgia, area may also have affected the Jasper County area. Damage figures are determined in dollar values at the time of the storm. No attempt has been made to adjust these figures to current dollar values.

August 16-19, 1871

A tropical cyclone moved overland from Florida and caused damage along the Florida, Georgia, and South Carolina coasts. At Savannah, the wind speed was 72 miles per hour (mph) from the north.

August 21-29, 1881

This storm reached hurricane intensity northeast of Puerto Rico on August 22. The lowest barometric pressure reading was 29.08 inches. The storm center entered the coast south of Savannah on August 27. Damage in Savannah was estimated at $1.5 million. Approximately 335 people were killed in and near the city. Nearly 100 vessels were wrecked along the

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Atlantic coast. Damage was very heavy on Tybee Island and other coastal islands near Savannah. The highest tide observed was estimated to reach an elevation of 16.5 feet msl at Savannah Beach, approximating a flood of at least a 100-year magnitude.

August 21-26, 1885

This storm moved inland north of Savannah on August 25. It caused heavy damage in the Carolinas, but only light damage in Georgia. Total damage was estimated at about $1.7 million.

August 15-September 2, 1893

This major hurricane, which originated near the Cape Verde Islands, reached the Georgia coast on August 27. It was accompanied by a tremendous storm wave that submerged the islands along the Georgia and South Carolina coasts. Between 2,000 and 2,500 people lost their lives on the coastal islands and in the lowland between Tybee Island and Charleston. Property damage along the Atlantic coast was estimated at $10 million. Nearly every building on Tybee Island was damaged and the railroad to the island was wrecked. The highest tide known to have occurred in the county was estimated to have a range of 17.0 to 19.5 feet msl at Savannah Beach, Georgia.

September 22-29, 1896

This hurricane entered the northwestern Florida coast near St. Mark. Its center passed through southeastern Georgia and South Carolina on September 28 and 29. Hurricane winds persisted when the hurricane moved inland. Savannah recorded maximum winds of 75 mph. Damage in Savannah was estimated at $1 million. Damage was also heavy on Tybee Island and over much of southeastern Georgia. Because the damaging hurricane wind was of a short duration near Chatham County and occurred during a low tide period, destruction caused by storm surge was relatively light compared with the hurricanes of 1881 and 1893.

August 30-September 1, 1898

This hurricane entered the Georgia-South Carolina coast on August 30. Its center passed over Tybee Island. Winds on Tybee Island were estimated at 100 mph. The storm surges were not high enough to cause extensive damage. However, the hurricane was accompanied by very heavy rain, and the countryside was flooded for 100 miles around Savannah. Most roads and railroads were impassable because of high water.

August 23-30, 1911

The center of this hurricane entered the coast between Savannah and Charleston on August 28. A maximum wind of 88 mph from the northwest was recorded at Savannah. Damage in the Savannah area was remarkably low. However, property on Tybee Island was heavily damaged. Excessive rains accompanied the storm and caused considerable damage to roads, crops, and other property throughout southern Georgia.

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August 5-15, 1940

This was the first hurricane to affect Georgia since August 1911. Its center entered the South Carolina coast to the north of Savannah on August 11. The wind at Savannah reached 73 mph, and damage in the Savannah area was estimated at $850,000. The highest tide observed at Beaufort, South Carolina, was estimated to be 12.4 feet msl. High tides of 7.4 and 6.4 feet msl were recorded at Fort Pulaski, Georgia, and at Fort Jackson, Savannah Harbor, Georgia, respectively.

October 12-23, 1944

This hurricane entered the gulf coast of Florida and moved northeastward across the peninsula. Its center crossed the east coast near Jacksonville, Florida, in a north-northeast direction and moved inland again near Savannah. The hurricane was downgraded to a tropical storm by the time it reached Georgia. The highest tide, 5.9 feet msl along the Georgia coast, was observed at Fort Pulaski, near the mouth of the Savannah River. The estimated damage in Georgia was $500,000.

October 9-16, 1947

The center of this hurricane entered the Georgia coast just south of Savannah on October 15. At Savannah, the maximum wind speed was 77 mph, and the lowest barometric pressure was 28.77 inches. Heavy losses were sustained at Savannah and Savannah Beach, where more than 1,500 buildings were substantially damaged. Total damage in the coastal area was estimated at more than $2 million. The highest tide, 7.9 feet msl, was recorded at Fort Jackson.

August 18-September 2, 1952 (Hurricane Able)

Hurricane Able moved inland on August 30. Its center passed near Beaufort with maximum winds of approximately 100 mph. Damage from this storm was estimated at about $2.8 million.

September 20-October 2, 1959 (Hurricane Gracie)

Hurricane Gracie moved inland on September 29. Its center passed over the South Carolina coast near Beaufort. Wind gusts of hurricane force were felt in the Savannah area, and damage was inflicted over the upper Georgia coastal area. The total damage inflicted by the storm was estimated at $14 million with damage in Georgia estimated at more than $500,000. High-water marks, which were reported near Edisto Beach, South Carolina, ranged from 7.3 to 11.9 feet msl.

August 25-September 7, 1979 (Hurricane David)

Hurricane David was the most intense storm of the century to affect the islands of the eastern Carribean. However, the storm was not a major hurricane when it struck the United States. David struck just north of Palm Beach, Florida, on September 3 and made a second landfall about 24 hours later near Savannah Beach, Georgia. In the United States, David was responsible for five deaths and about $300 million in damages. The death

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toll and damage were much greater in Dominica, Cuba, and the Dominican Republic (Reference 7).

2.4 Flood Protection Measures

Applicable Federal or state funded flood protection measures have not been employed in Jasper County. However, scattered flood and erosion protection measures have been constructed on private properties. These protection measures offer minimal protection.

3.0 ENGINEERING METHODS

For the flooding sources studied in detail in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude that are expected to be equaled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for flood plain management and for flood insurance rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10, 2, 1, and 0.2 percent chance, respectively, of being equaled or exceeded during any year. Although the recurrence interval represents the long-term average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than 1 year are considered. For example, the risk of having a flood that equals or exceeds the 100-year flood (1 percent chance of annual exceedence) in any 50-year period is approximately 40 percent (4 in 10), and, for any 90-year period, the risk increases to approximately 60 percent (6 in 10). The analyses reported herein reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak discharge-frequency relationships for each riverine flooding source studied in detail affecting the community. Analyses were also carried out to establish the peak elevation-frequency relationships for each coastal flooding source studied in detail.

All hydrologic analyses for the Savannah River were taken from the Type 19 Flood Insurance Study for the Unincorporated Areas of Chatham County (Reference 1).

Inundation from the Atlantic Ocean caused by passage of storms (storm surge) was determined by the joint probability method (Reference 8). The storm populations were described by probability distributions of 5 parameters that influence surge heights. These were central pressure depression (which measures the intensity of the storm), radius to maximum winds, forward speed of the storm, shoreline crossing point, and crossing angle. These characteristics were described statistically based on an analysis of observed storms in the vicinity of Jasper County. Primary sources of data for this were "Tropical Cyclone Card Deck 993" (Reference 9), "Tropical Cyclones of the North Atlantic Ocean, 1871-1980" (Reference 10), "Tropical Cyclones of the North Atlantic Ocean" (Reference 11), and "Some Climatological Characteristics of Hurricanes and Tropical Storms,

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Gulf and East Coasts of the United States" (Reference 12). A summary of the parameters used for the area is presented in Table 1, Parameter Values for Surge Elevations.

For areas subject to flooding directly from the Atlantic Ocean, the FEMA standard storm surge model was used to simulate the coastal surge generated by any chosen storm (that is, any combination of the 5 storm parameters defined previously). By performing such simulations for a large number of storms, each of known total probability, the frequency distribution of surge height can be established as a function of coastal location. These distributions incorporate the large-scale surge behavior, but do not include an analysis of the added effects associated with much finer scale wave phenomena, such as wave height or runup. As the final step in the calculations, the astronomic tide for the region is then statistically combined with the computed storm surge to yield recurrence intervals of total water level (Reference 13).

The storm-surge elevations for the 10-, 50-, 100-, and 500-year floods have been determined for Jasper County and are shown in Table 2, Summary of Stillwater Elevations. The analyses reported herein reflect the stillwater elevations due to tidal and wind setup effects and include the contributions from wave action effects.

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of flooding from the riverine sources studied were carried out to provide estimates of the elevations of floods of the selected recurrence intervals.

All hydraulic data, including water-surface profiles, for the Savannah River were taken from the Type 19 Flood Insurance Study for the Unincorporated Areas of Chatham County (Reference 1).

Flood profiles were drawn showing the computed water-surface elevations for floods of the selected recurrence intervals. In cases where the 50- and 100-year flood elevations are close together, due to limitations of the profile scale, only the 100-year profile has been drawn.

The hydraulic analyses for the riverine study are based only on the effects of unobstructed flow. The flood elevations shown on the profiles are, thus, considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail.

Hydraulic analyses, considering storm characteristics and the shoreline and bathymetric characteristics of the flooding sources studied, were carried out to provide estimates of the elevations of floods of the selected recurrence intervals along each of the shorelines.

The FEMA storm surge model was utilized to simulate the hydrodynamic behavior of the surge generated by the various synthetic storms. This model utilizes a grid pattern approximating the geographical features of the study area and the adjoining areas. Surges were computed utilizing grids of 5 nautical miles by 8 nautical miles and 10,000 feet by 10,000 feet, depending on the resolution required.

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CENTRAL PRESSURE DEPRESSION (MILLIBARS)	83	67	53	42	33	23	9
ASSIGNED PROBABILITIES[1]	0.03	0.08	0.11	0.13	0.16	0.29	0.20
STORM RADIUS TO MAXIMUM WINDS (NAUTICAL MILES)	12			20			28
PROBABILITY[1]	0.24			0.26			0.50
FORWARD SPEED (KNOTS)	7			11			15
PROBABILITIES:[1]	0.45			0.30			0.25
DIRECTION OF STORM PATH[1] (DEGREES FROM TRUE NORTH)			327		301		
PROBABILITY[1]			0.51		0.49		
FREQUENCY OF STORM OCCURRENCE (STORM/NAUTICAL MILE/YEAR)	65[2] 0.00107		20[2] 0.0012		25[3] 0.00124		70[3] 0.00131

[1]AVERAGE OF DIFFERENT STORM TRACK LOCATIONS
[2]NAUTICAL MILES SOUTH OF GEORGIA-SOUTH CAROLINA BOUNDARY
[3]NAUTICAL MILES NORTH OF GEORGIA-SOUTH CAROLINA BOUNDARY

TABLE 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

JASPER COUNTY, SC

(UNINCORPORATED AREAS)

PARAMETER VALUES FOR SURGE ELEVATIONS

(ENTERING HURRICANES)

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CENTRAL PRESSURE DEPRESSION (MILLIBARS)	83	67	53	42	33	23	9
ASSIGNED PROBABILITIES[1]	0.03	0.08	0.11	0.13	0.16	0.29	0.20
STORM RADIUS TO MAXIMUM WINDS (NAUTICAL MILES)	12			20			28
PROBABILITY[1]	0.24			0.26			0.50
FORWARD SPEED (KNOTS)	7			11			15
PROBABILITIES:[1]	0.32			0.30			0.38
DIRECTION OF STORM PATH[1] (DEGREES FROM TRUE NORTH)				35			
PROBABILITY[1]				1.0			
FREQUENCY OF STORM OCCURRENCE (STORM/NAUTICAL MILE/YEAR)	65[2] 0.0039[4] 0.0042[5]		20[2] 0.0045[4] 0.0048[5]		25[3] 0.0051[4] 0.0054[5]		70[3] 0.0058[4] 0.0061[5]

[1]AVERAGE OF DIFFERENT STORM TRACK LOCATIONS
[2]NAUTICAL MILES SOUTH OF GEORGIA-SOUTH CAROLINA BOUNDARY
[3]NAUTICAL MILES NORTH OF GEORGIA-SOUTH CAROLINA BOUNDARY
[4]15 NAUTICAL MILES OFFSHORE
[5]45 NAUTICAL MILES OFFHSORE

TABLE 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

JASPER COUNTY, SC

(UNINCORPORATED AREAS)

PARAMETER VALUES FOR SURGE ELEVATIONS

(ALONGSHORE HURRICANES)

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CENTRAL PRESSURE DEPRESSION (MILLIBARS)	83	67	53	42	33	23	9
ASSIGNED PROBABILITIES[1]	0.03	0.08	0.11	0.13	0.16	0.29	0.20
STORM RADIUS TO MAXIMUM WINDS (NAUTICAL MILES)	12			20			28
PROBABILITY[1]	0.24			0.26			0.50
FORWARD SPEED (KNOTS)	7						13
PROBABILITIES:[1]	0.45						0.55
DIRECTION OF STORM PATH[1] (DEGREES FROM TRUE NORTH)			54		94		
PROBABILITY[1]			0.75		0.25		
FREQUENCY OF STORM OCCURRENCE (STORM/NAUTICAL MILE/YEAR)	65[2] 0.0026		20[2] 0.0013		25[3] 0.00069		70[3] 0.00056

[1]AVERAGE OF DIFFERENT STORM TRACK LOCATIONS
[2]NAUTICAL MILES SOUTH OF GEORGIA-SOUTH CAROLINA BOUNDARY
[3]NAUTICAL MILES NORTH OF GEORGIA-SOUTH CAROLINA BOUNDARY

TABLE 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

JASPER COUNTY, SC

(UNINCORPORATED AREAS)

PARAMETER VALUES FOR SURGE ELEVATIONS

(EXITING HURRICANES)

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FLOODING SOURCE AND LOCATION	TRANSECT	STILLWATER ELEVATION (FEET NGVD)			
		10% (10-YEAR)	2% (50-YEAR)	1% (100-YEAR)	0.2% (500-YEAR)
ATLANTIC OCEAN					
Along Savannah River from divergence of South Channel to Fig Island	1-2	10.3	12.5	13.0	15.5
Near Turtle Island	3-6	11.1	13.0	14.0	15.5
Along Wright River from confluence of Mud River upstream to headwaters	N/A	10.8	12.5	13.0	15.1
From Clydesdale Creek to intersection of State Highway 170 and State Road 89	N/A	10.0	11.3	12.0	13.5
From about 3000 feet south of intersection of Interstate 17 and Interstate 17A to State Route 141 bridge over New River	N/A	8.9	10.3	10.8	12.3
From Hazzards Creek to Branch Creek	7,8,9	11.7	13.6	14.0	15.8

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

JASPER COUNTY, SC

(UNINCORPORATED AREAS)

SUMMARY OF STILLWATER ELEVATIONS

ATLANTIC OCEAN

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The FEMA storm surge model employs a 2-dimensional grid along with a 1-dimensional embedded river model. The 2-dimensional grid was extended approximately 20 nautical miles inland from the coastline. The 1-dimensional river model was extended beyond the limit of the 2-dimensional grid along the Savannah River to a point where the river becomes ill-defined near its head.

Underwater depths and land heights for the model grid systems were obtained from National Oceanic and Atmospheric Administration (NOAA) nautical charts, U.S. Geological Survey topographic maps, aerial photogrammetry, and field surveys conducted as part of this study (References 14-18).

The methodology for analyzing the effects of wave heights associated with coastal storm surge flooding is described in a report prepared by the National Academy of Sciences (Reference 19). This method is based on the following major concepts. First, depth-limited waves in shallow water reach a maximum breaking height that is equal to 0.78 times the stillwater depth. The wave crest is 70 percent of the total wave height above the stillwater level. The second major concept is that wave height may be diminished by dissipation of energy due to the presence of obstructions, such as sand dunes, dikes and seawalls, buildings, and vegetation. The amount of energy dissipation is a function of the physical characteristics of the obstruction and is determined by procedures prescribed in Reference 19. The third major concept is that wave height can be regenerated in open fetch areas due to the transfer of wind energy to the water. This added energy is related to fetch length and depth.

Wave heights were computed along transects (cross-section lines) that were located along the coastal areas, as illustrated in Figure 2, Transect Location Map, in accordance with the "Users Manual for Wave Height Analysis" (Reference 20). The transects were located with consideration given to the physical and cultural characteristics of the land so that they would closely represent conditions in their locality. Transects were spaced close together in areas of complex topography and dense development. In areas having more uniform characteristics, they were spaced at large intervals. It was also necessary to locate transects in areas where unique flooding existed and in areas where computed wave heights varied significantly between adjacent transects.

Each transect was taken perpendicular to the shoreline and extended inland to a point where wave action ceased. Along each transect, wave heights and elevations were computed considering the combined effects of changes in ground elevation, vegetation, and physical features. The stillwater elevations for the 100-year flood were used as the starting elevations for these computations. Wave heights were calculated to the nearest 0.1 foot, and wave elevations were determined at whole-foot increments along the transects. The location of the 3-foot breaking wave for determining the terminus of the V zone (area with velocity wave action) was also computed at each transect. Table 3 provides a listing of the transect locations and stillwater starting elevations, as well as initial wave crest elevations.

Figure 3 represents a sample transect that illustrates the relationship between the stillwater elevation, the wave crest elevation, the ground elevation profile, and the location of the A/V zone boundary.

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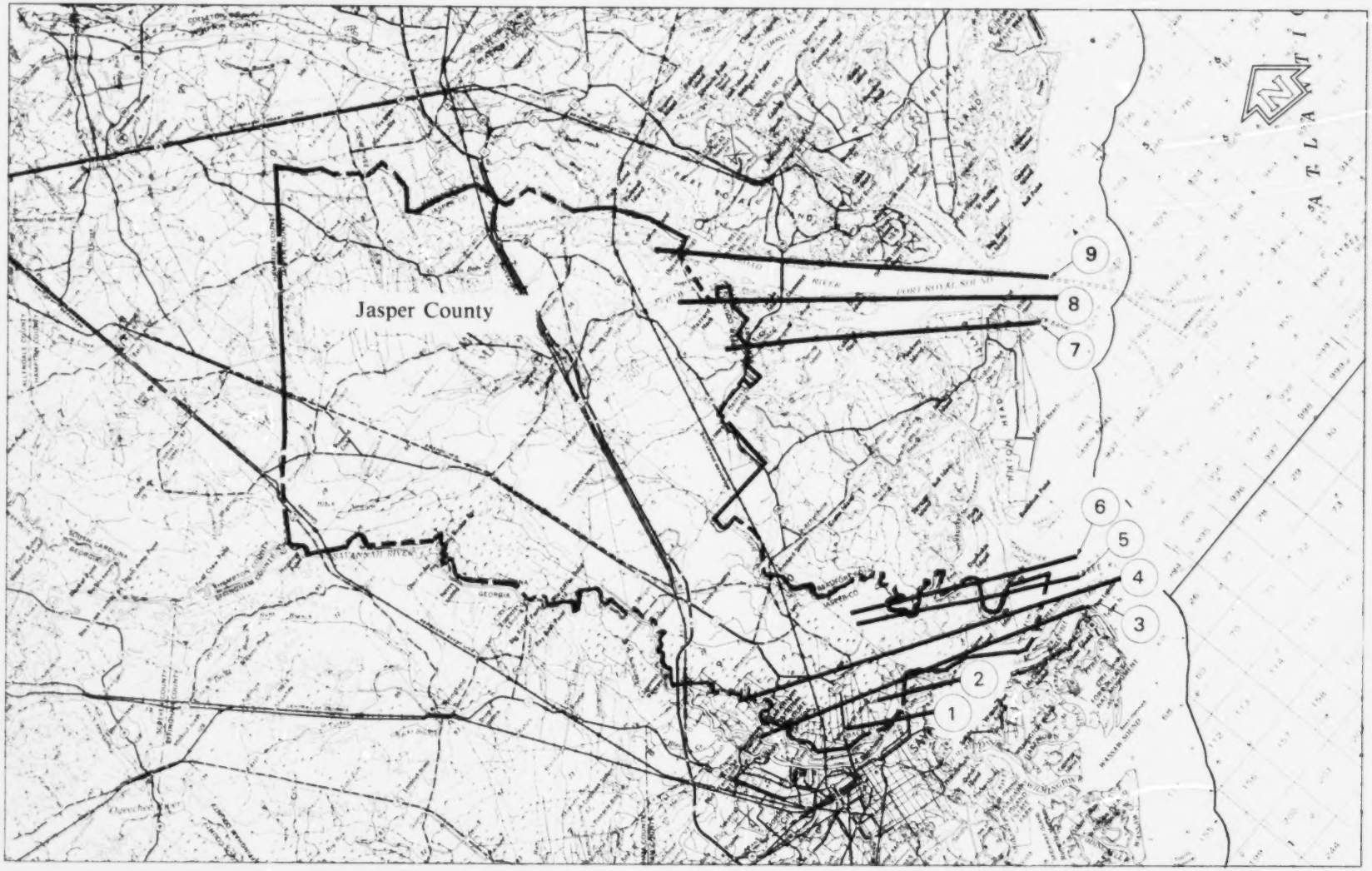

FIGURE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

JASPER COUNTY, SC

(UNINCORPORATED AREAS)

APPROXIMATE SCALE

8 0 8 16 24 MILES

TRANSECT LOCATION MAP

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TABLE 3 - TRANSECT LOCATIONS, STILLWATER STARTING ELEVATIONS, AND INITIAL WAVE CREST ELEVATIONS

Transect	Location	Elevation (Feet) Stillwater	Wave Crest
1	across Tybee Island approximately 2 miles southeast of the mouth of the Bull River (in Chatham County)	13.0	20.1
2	across Tybee Island approximately 2.3 miles southeast of the mouth of the Bull River (in Chatham County)	13.0	20.1
3	across the southern end of Turtle Island through the wildlife refuge, crossing U.S. Route 17 where it crosses the Front River	14.0	21.6
4	across the middle of Turtle Island, through Monkey John Swamp, crossing U.S. Route 17 approximately 1 mile west of the junction with U.S. Route 17A	14.0	21.6
5	across the northern portion of Turtle Island approximately 4,000 feet north of Walls Cut, continuing inland approximately 3,000 feet north of Glasgow Landing	14.0	21.6
6	across the southern portion of Daufuskie Island, continuing acoss the New River approximately 3,000 feet southwest of Doughboy Island	14.0	21.6
7	across Hilton Head Island in the northern end, continuing along the Chechesse River (in Town of Hilton Head)	14.0	21.6
8	through the middle of Daws Island, Lemon Island, continuing near Bolon Hall Landing (in Beaufort County)	14.0	21.6
9	across the southern end of Port Royal Island, continuing up the Broad River and crossing Boyd Creek near Boyd Neck (in Beaufort County)	14.0	21.6

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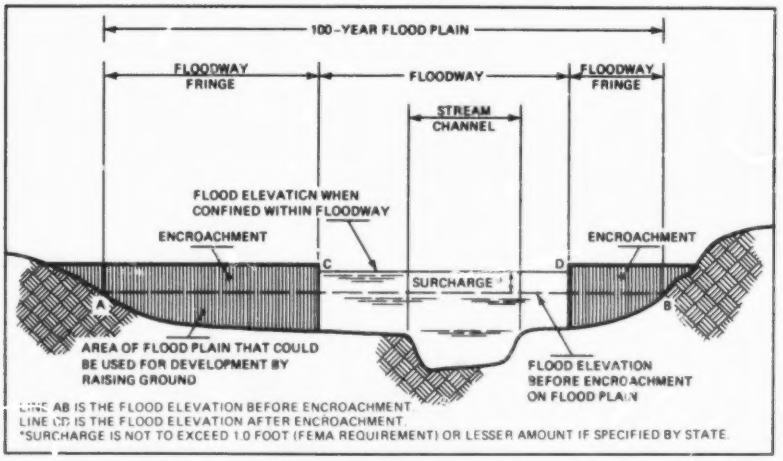
100-YEAR FLOOD PLAIN
FLOODWAY FRINGE
FLOODWAY
FLOODWAY FRINGE
STREAM CHANNEL
FLOOD ELEVATION WHEN CONFINED WITHIN FLOODWAY
ENCROACHMENT
ENCROACHMENT
C
D
SURCHARGE*
A
B
AREA OF FLOOD PLAIN THAT COULD BE USED FOR DEVELOPMENT BY RAISING GROUND
FLOOD ELEVATION BEFORE ENCROACHMENT ON FLOOD PLAIN
LINE AB IS THE FLOOD ELEVATION BEFORE ENCROACHMENT.
LINE CD IS THE FLOOD ELEVATION AFTER ENCROACHMENT.
*SURCHARGE IS NOT TO EXCEED 1.0 FOOT (FEMA REQUIREMENT) OR LESSER AMOUNT IF SPECIFIED BY STATE.

FIGURE 3 - Transect Schematic

After analyzing wave heights along each transect, wave elevations were interpolated between transects. Various source data were used in the interpolation, including topographic maps (References 16 and 17), aerial photographs (Reference 18), and engineering judgment. Controlling features affecting the elevations were identified and considered in relation to their positions at a particular transect and their variation between transects.

All elevations are referenced to the National Geodetic Vertical Datum of 1929 (NGVD).

4.0 FLOOD PLAIN MANAGEMENT APPLICATIONS

The National Flood Insurance Program encourages state and local governments to adopt sound flood plain management programs. Therefore, each Flood Insurance Study produces maps designed to assist communities in developing flood plain management measures.

4.1 Flood Boundaries

To provide a national standard without regional discrimination, the 1 percent annual chance (100-year) flood has been adopted by FEMA as the base flood for flood plain management purposes. The 0.2 percent annual chance (500-year) flood is employed to indicate additional areas of flood risk in the community. For each stream studied in detail, the 100- and 500-year flood plain boundaries have been delineated using the flood elevations determined at each cross section. Between cross sections, the boundaries were interpolated using topographic maps at a scale of 1:24000 with a contour interval of 10 feet (Reference 16). For each coastal flooding source studied in detail, the 100- and 500-year flood plain boundaries have been delineated using the flood elevations determined at each transect. Between transects, the boundaries were interpolated using topographic maps at a scale of 1:24000 with contour intervals of 5 and 10 feet (References 16 and 17).

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For the streams studied by approximate methods, only the 100-year flood plain boundary was delineated using the Flood Hazard Boundary Map for Jasper County (Reference 21).

Flood plain boundaries are indicated on the Flood Insurance Rate Map. On this map, the 100-year flood plain boundary corresponds to the boundary of the areas of special flood hazards (Zone A, numbered A zones, and numbered V zones) and the 500-year flood plain boundary corresponds to the boundary of areas of moderate flood hazards (Zone B). In cases where the 100- and 500-year flood plain boundaries are close together, only the 100-year flood plain boundary has been shown. Small areas within the flood plain boundaries may lie above the flood elevations but cannot be shown due to limitations of the map scale and/or lack of detailed topographic data.

4.2 Floodways

The floodway is the channel of a stream plus any adjacent flood plain areas that must be kept free of encroachment so that the 100-year flood can be carried without substantial increases in flood heights. Minimum Federal standards limit such increases to 1.0 foot, provided that hazardous velocities are not produced.

No floodway was determined for the Savannah River in the Type 19 Flood Insurance Study for Chatham County (Reference 1).

5.0 INSURANCE APPLICATION

To establish actuarial insurance rates, data from the engineering study must be transformed into flood insurance criteria. This process includes the determination of reaches, Flood Hazard Factors, and flood insurance zone designations for each flooding source studied in detail affecting Jasper County.

5.1 Reach Determinations

For riverine studies, reaches are defined as sections of flood plain that have relatively the same flood hazard, based on the weighted average difference in water-surface elevations between the 10- and 100-year floods. This difference may not have a variation greater than that indicated in the following table for more than 20 percent of the reach:

Average Difference Between 10- and 100-year Floods	Variation
Less than 2 feet	0.5 foot
2 to 7 feet	1.0 foot
7.1 to 12 feet	2.0 feet
More than 12 feet	3.0 feet

The locations of the reaches determined for the riverine flooding source of Jasper County are shown on the Flood Profile and summarized in Table 4, Flood Insurance Zone Data.

In coastal areas, reaches are limited to the distance for which the 100-year flood elevation does not vary more than 1.0 foot. Coastal flood plains are

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divided into areas having relatively the same flood hazard based upon the 100-year wave height and the weighted average difference in water-surface elevations between the 10- and 100-year floods. These flood hazard areas are shown on the Flood Insurance Rate Map and summarized in Table 5, Coastal Flood Insurance Zone Data.

5.2 Flood Hazard Factors

The Flood Hazard Factor (FHF) is used to establish relationships between depth and frequency of flooding in any reach. This relationship is then used with depth-damage relationships for various classes of structures to establish actuarial insurance rate tables.

The FHF for a riverine reach is the weighted average difference between the 10- and 100-year flood water-surface elevations rounded to the nearest 0.5 foot, multiplied by 10, and shown as a 3-digit code.

The FHF for areas subject only to storm surge flooding is the difference between the 10- and 100-year stillwater elevations rounded to the nearest 0.5 foot, multiplied by 10, and shown as a 3-digit code. For areas with wave heights less than 3 feet, the FHF is the weighted average difference between the 100-year wave crest elevation and the 10-year stillwater elevation. For areas with wave heights greater than 3 feet, the FHF is determined using the difference between the 10- and 100-year stillwater elevations multiplied by 1.55, then rounded to the nearest 0.5 foot, multiplied by 10, and shown as a 3-digit code.

For example, if the difference between elevations is 0.7 foot, the FHF is 005; if the difference is 1.4 feet, the FHF is 015; if the difference is 5.0 feet, the FHF is 050. When the difference is greater than 10.0 feet, it is rounded to the nearest whole foot.

5.3 Flood Insurance Zones

Flood insurance zones and zone numbers are assigned based on the type of flood hazard and the FHF, respectively. A unique zone number is associated with each possible FHF and varies from 1 for a FHF of 005 to a maximum of 30 for a FHF of 200 or greater.

Zone A:	Special Flood Hazard Areas inundated by the 100-year flood, determined by approximate methods; no base flood elevations are shown or FHFs determined.
Zones A4, A7-A11:	Special Flood Hazard Areas inundated by the 100-year flood, with base flood elevations shown, and zones subdivided according to FHFs.
Zone V9:	Special Flood Hazard Areas along coasts inundated by the 100-year flood that have additional velocity hazards associated with waves of 3-foot amplitude or greater, with base flood elevations shown, and zones subdivided according to FHFs.

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Zone B:	Areas between Special Flood Hazard Areas and the limits of the 500-year flood; areas that are protected from the 100- and 500-year floods by dike, levee, or other water control structure; areas subject to certain types of 100-year shallow flooding where depths are less than 1.0 foot; and, areas subject to 100-year flooding from sources with drainage areas of less than 1 square mile. Zone B is not subdivided.
Zone C:	Areas of minimal flooding; not subdivided.

Flood elevation differences, FHFs, flood insurance zones, and base flood elevations for each flooding source studied in detail in the community are shown in Table 4, Flood Insurance Zone Data, and Table 5, Coastal Flood Insurance Zone Data.

5.4 Flood Insurance Rate Map Description

The Flood Insurance Rate Map for Jasper County is, for insurance purposes, the principal product of the Flood Insurance Study. This map contains the official delineation of flood insurance zones and base flood elevation lines. Base flood elevation lines for riverine flooding sources show the locations of the expected whole-foot water-surface elevations of the base (100-year) flood. For coastal flooding sources, the expected water-surface elevations of the base (100-year) flood are shown as a weighted average within zones. Each whole-foot elevation is delineated except where cartographic considerations require the combination of two or more elevation zones. The base flood elevations and zone numbers are used by insurance agents, in conjunction with structure elevations and characteristics, to assign actuarial insurance rates to structures and contents insured under the National Flood Insurance Program.

6.0 OTHER STUDIES

Previous studies have been conducted by several agencies for the entire coast of South Carolina. In 1973, the South Carolina Disaster Preparedness Agency published a study of meteorological characteristics of tropical cyclones along the South Carolina coast (Reference 22).

In June 1975, NOAA developed predictions of hurricane tidal surges along the South Carolina coast (Reference 23). The NOAA study used a different computer program than the TTSURGE program used in this study. The TTSURGE program is the methodology currently used by FEMA (Reference 13). The two sets of predicted surges in the range of 50- to 100-year return period agreed. For smaller return periods (e.g., 10-year), this study found higher surges. This may be explained by the fact that NOAA neglected exiting hurricanes that typically produce small (but significant) surges. For higher return periods (e.g., 500-year), this study predicted smaller surges than NOAA. It appears that this difference is partially due to an attempt by NOAA to calibrate its predictions against high water marks data that most likely are too high due to the effects of wave setup and runup.

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FLOODING SOURCE	PANEL[1]	ELEVATION DIFFERENCE[2] BETWEEN 1.0% (100-YEAR) FLOOD AND			FLOOD HAZARD FACTOR	ZONE	BASE FLOOD ELEVATION[3] (FEET NGVD)
		10% (10-YEAR)	2% (50-YEAR)	0.2% (500-YEAR)			
SAVANNAH RIVER							
REACH 1	0175,0225	−3.8	N/A	N/A	040	A8	VARIES—SEE MAP
REACH 2	0175	−5.7	N/A	N/A	055	A11	VARIES—SEE MAP

[1]FLOOD INSURANCE RATE MAP PANEL
[2]WEIGHTED AVERAGE
[3]ROUNDED TO NEAREST FOOT

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TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

JASPER COUNTY, SC

(UNINCORPORATED AREAS)

FLOOD INSURANCE ZONE DATA

SAVANNAH RIVER

FLOODING SOURCE	TRANSECT	PANEL[1]	ELEVATION DIFFERENCE[2] BETWEEN 1.0% (100-YEAR) FLOOD AND 10% (10-YEAR)	FLOOD HAZARD FACTOR	ZONE	BASE FLOOD ELEVATION[3,4] (FEET NGVD)
ATLANTIC OCEAN	1	0220,0240	−3.7[5]	035	A7	13−17
	2	0220,0240	−4.5[5] −3.7[5]	045 035	V9 A7	16−18 13−15
	3	0220,0230,0240, 0245,0255	−4.5[5] −4.5[5] −3.5[5]	045 045 035	V9 A9 A7	16−22 14−16 13−15
	N/A	0200,0220,0225, 0230,0240	−2.0	020	A4	11−12
	N/A	0175,0200,0225, 0230	−1.9	020	A4	11
	4	0220,0230,0240, 0245,0255	−4.5[5] −3.5[5]	045 035	V9 A7	16−22 13−16
	5	0230,0240,0245, 0255	−4.5[5] −3.5[5]	045 035	V9 A7	16−22 13−16
	6	0230,0240,0245	−3.5[5]	035	A7	13−15
	7	0150	−4.0[5] −4.5[5] −5.0[5]	040 045 050	A8 A9 A10	14 14 15
	8	0150	−4.5[5]	045	A9	14−16
	9	0100,0150	−4.5[5]	045	A9	14−16

[1]FLOOD INSURANCE RATE MAP PANEL
[2]WEIGHTED AVERAGE IN FEET
[3]ROUNDED TO NEAREST FOOT
[4]DUE TO MAP SCALE LIMITATIONS, BASE FLOOD ELEVATIONS SHOWN ON MAP MAY REPRESENT AVERAGE ELEVATIONS FOR THE ZONES DEPICTED
[5]INCLUDES EFFECTS OF WAVE ACTION

TABLE 5

FEDERAL EMERGENCY MANAGEMENT AGENCY

JASPER COUNTY, SC

(UNINCORPORATED AREAS)

COASTAL FLOOD INSURANCE ZONE DATA

ATLANTIC OCEAN

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The effects of the use of high water marks, biased by wave action, are presented in a study prepared by Bernard Le Mehaute (Reference 24). In this study, a critical analysis of storm surge and wave crest elevation computed along the South Carolina shoreline is presented. He recommended that flood insurance criteria available at that time, which were based on the NOAA stillwater modeling, be updated by conducting a new study using the TTSURGE methodology.

Type 15 Flood Insurance Studies have been published for the Unincorporated Areas of Chatham County, Georgia, and Beaufort County, South Carolina (References 25 and 26). Both studies will be superseded by Type 19 Flood Insurance Studies in progress (References 1 and 27). The Type 19 studies match this Flood Insurance Study exactly.

Due to its more detailed analysis, this Flood Insurance Study supersedes the previously printed Flood Hazard Boundary Map for Jasper County (Reference 21).

7.0 LOCATION OF DATA

Information concerning the pertinent data used in the preparation of this study can be obtained by contacting the Natural and Technological Hazards Division, FEMA, 1371 Peachtree Street, NE., Suite 736, Atlanta, Georgia 30309.

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REACH 1
ZONE A8

REACH 2
ZONE A11

U.S. ROUTE 17

LIMIT OF DETAILED STUDY

FLOODING DOWNSTREAM OF THIS POINT CONTROLLED BY ATLANTIC OCEAN

ELEVATION IN FEET (NGVD)

20
15
10
5

0 5000 10,000 15,000 20,000 25,000 30,000

STREAM DISTANCE IN FEET ABOVE U.S. ROUTE 17

LEGEND

- 500–YEAR FLOOD
- 100–YEAR FLOOD
- 50–YEAR FLOOD
- 10–YEAR FLOOD
- STREAM BED
- (A) CROSS SECTION LOCATION

FLOOD PROFILES

SAVANNAH RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

JASPER COUNTY, SC
(UNINCORPORATED AREAS)

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